

Remarks/Arguments:

Claims 1, 3, 4, 7, 8, 28-32, 35, 37, and 42-55 are the pending claims in this application. Claims 7 and 55 are withdrawn. Claims 1, 3, 31, 44, 50, and 55 are currently amended. The amendments are supported throughout the original specification. No new matter has been added.

Specification and claims 3 and 44

The specification and claims 3 and 44 are currently amended to correct an error, which would have been obvious to one of ordinary skill in the art. At page 5, lines 15-17, the specification describes that NO₂ can account for up to about 50% NO_x in the exhaust gas of an internal combustion engine. The ratio of C1 HC/NO_x is from 0.1 to 2 (i.e., see claim 1). If NO₂ accounts for half of the NO_x in this ratio, then the denominator would be divided by 2. When the denominator of a fraction is divided by a number, the overall fraction is multiplied by the number. Thus, the range of the ratio of HC/NO₂, when half the NO_x is NO₂, is equal to 0.2 to 4. As one of ordinary skill in the art would have recognized that this correction is merely making the application consistent (e.g., making claim 3 consistent with claim 1), this amendment is supported by the specification and no new matter has been added.

Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 1, 31, 43, and 50 stand rejected as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter of the invention.

Claims 1 and 43 are rejected for use of the phrase "passing the effluent gas from the contacting step *to atmosphere*." Applicants respectfully submit that one of ordinary skill in the art would clearly recognize "to atmosphere" means releasing the effluent gas from the exhaust gas system into the surrounding environment. Accordingly, Applicants submit that "to atmosphere" is sufficiently definite and request that the rejection be withdrawn.

Claims 31 and 50 are rejected due to use of the term "PGM." Applicants respectfully submit that PGM is well known by those of ordinary skill in the art as a common abbreviation for "platinum group metals." In particular, the platinum group metals generally include

ruthenium, rhodium, palladium, osmium, iridium, and platinum. Thus, Applicants respectfully submit that this term is clear on its face, but have amended claims 31 and 50 to recite "platinum group metal" in order to expedite prosecution. Accordingly, Applicants respectfully submit that this rejection is now moot.

Double Patenting

Claims 1, 3, 4, 28, 29, 43-45, 47, and 48 are provisionally rejected for nonstatutory obviousness-type double patenting as unpatentable over claims 39, 42-47, and 59 of co-pending Application No. 11/665,308. Applicants request that the rejection be held in abeyance pending an indication of allowable subject matter.

Rejections Under 35 U.S.C. § 103

Claims 1, 3, 4, 8, 28-32, 35, 37 and 42-54 stand rejected as obvious over European Publication No. 0758713 ("Murachi") in view of European Publication No. 0541271 ("Subramanian"). Applicants respectfully traverse this rejection.

"To establish a *prima facie* case of obviousness, ... the prior art reference (or references when combined) must teach or suggest all the claim limitations." M.P.E.P. §2143. Additionally, as set forth by the Supreme Court in KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007), it is necessary to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the prior art elements in the manner claimed.

Murachi discloses two types of catalysts - an oxidizing catalyst and a NO_x reducing catalyst. The oxidizing catalyst oxidizes NO in the exhaust gas and converts it to NO₂. Col. 4, lines 56-59 of Murachi. The NO_x reducing catalyst reduces NO_x in the exhaust gas to N₂. Col. 16, lines 57-59 of Murachi. Murachi also discloses a NO_x absorbent that absorbs and releases NO_x under suitable conditions. Col. 5, lines 44-58 of Murachi.

Subramanian discloses a two-stage catalyst system: a first stage catalyst; and a second stage three-way catalyst, which reduces NO_x to N₂ and oxidizes CO and hydrocarbons (HC) to CO₂ and H₂O.

In the present invention, however, nitrogen dioxide (NO₂) is decomposed to nitrogen monoxide (NO). In other words, NO_x remains, albeit in a different form.

Claims 1, 3, 4, 8, 28-32, 35, 37 and 42

With respect to currently amended claim 1, a *prima facie* case of obviousness has not been shown because the proposed combination of Murachi and Subramanian does not disclose or suggest contacting the gas mixture from the adjusting step with a particulate acidic refractory oxide selected from the group consisting of zeolites, tungsten-doped titania, silica-titania, zirconia-titania, and mixtures of any two or more thereof, wherein the particulate refractory oxide supports a metal of rhodium, palladium, or mixtures thereof.

Claim 1, as currently amended, recites in part:

contacting the gas mixture from the adjusting step with a particulate acidic refractory oxide selected from the group consisting of zeolites, tungsten-doped titania, silica-titania, zirconia-titania, and mixtures of any two or more thereof, wherein the particulate refractory oxide supports a metal or a compound thereof, which metal is selected from the group consisting of rhodium, palladium, and mixtures thereof; and passing the effluent gas from the contacting step to atmosphere.

First, Murachi and Subramanian, alone or in any reasonable combination, fail to disclose or suggest contacting the gas mixture from the adjusting step with a particulate acidic refractory oxide selected from the group consisting of zeolites, tungsten-doped titania, silica-titania, zirconia-titania, and mixtures of any two or more thereof, wherein the particulate refractory oxide supports a metal of rhodium, palladium, or mixtures thereof. Murachi, discussed in the present application at page 3, describes an exhaust system comprising an optionally platinum-based oxidation catalyst, a diesel particulate filter, and a NO_x absorbent downstream. Murachi discloses a NO_x reducing catalyst with certain compounds that may be attached to a zeolite substrate, such as copper, iron, and platinum. See col. 16, lines 50-56 of Murachi. Claim 1 has been amended to exclude copper and iron, which were relied upon in the Office Action to make this rejection. Thus, claim 1 is patentably distinct from the references because Murachi fails to disclose or suggest a particulate acidic refractory oxide that supports rhodium, palladium, or mixtures thereof.

Claim 1 has been amended to further distinguish from the references by excluding gamma-alumina and amorphous silica-alumina from the choices of its particulate acidic refractory oxide. Murachi discloses alumina for use in an oxidizing catalyst which can support, for example, palladium and a NO_x absorbent to support rhodium. See col. 4, lines 50-56 and col. 5, lines 44-53 of Murachi. The alumina carrier described, however, is not a particulate acidic refractory oxide as currently claimed. Thus, the rhodium and palladium disclosed are not supported on the particulate acidic refractory oxide as claimed. Therefore, Murachi fails to disclose or suggest a particulate acidic refractory oxide, as claimed, that supports rhodium, palladium, or mixtures thereof.

Subramanian fails to remedy the deficiencies of Murachi. Subramanian, also discussed in the present application at page 5, describes a catalyst system for treating NO_x in the exhaust with a first stage catalyst comprising a transition metal-exchanged zeolite and a second stage three-way catalyst. The first stage catalyst comprises a transition metal-exchanged zeolite, such as copper ion-exchanged ZSM5 zeolite. Col. 1, lines 46-53 of Subramanian. Subramanian fails to disclose or suggest, however, a particulate acidic refractory oxide that supports rhodium, palladium, or mixtures thereof.

It is noted that Subramanian further discloses a second stage three-way catalyst that comprises a high surface area alumina support impregnated with lanthana, palladium, and titania. The particulate acidic refractory oxide of claim 1 is selected from zeolites, tungsten-doped titania, silica-titania, zirconia-titania, and mixtures. Thus, the palladium disclosed is not supported on a particulate acidic refractory oxide as currently claimed. Therefore, Subramanian also fails to disclose or suggest a particulate acidic refractory oxide, as claimed, that supports rhodium, palladium, or mixtures thereof.

Accordingly, none of the references, alone or in any reasonable combination, teaches each of the claimed limitations. Thus, Applicants respectfully submit a *prima facie* case of obviousness has not been established, and claim 1 should be in condition for allowance. Claims 3, 4, 8, 28-32, 35, 37, and 42 depend, directly or indirectly, from claim 1 and should be deemed allowable as dependent thereon. Claim 55 has been amended in a manner consistent

with claim 1 and is believed to share the same special technical features of claim 1, and therefore should be allowed along with claim 1.

Claims 43-54

With respect to claim 43, a *prima facie* obviousness has not been shown because (1) the proposed combination of Murachi and Subramanian does not disclose or suggest contacting the gas mixture from the adjusting step with a catalyst consisting of a particulate acidic refractory oxide selected from the group consisting of zeolites, tungsten-doped titania, silica-titania, zirconia-titania, gamma-alumina, amorphous silica-alumina and mixtures of any two or more thereof; and (2) Murachi and Subramanian teach away from the claimed invention because they require metals in the catalyst.

Murachi and Subramanian, alone or in any reasonable combination, fail to disclose or suggest a catalyst *consisting of* a particulate acidic refractory oxide selected from the group consisting of zeolites, tungsten-doped titania, silica-titania, zirconia-titania, gamma-alumina, amorphous silica-alumina and mixtures of any two or more thereof. The transitional phrase "consisting of" excludes any element, step, or ingredient not specified in the claim. See M.P.E.P. 2111.03. Thus, the catalyst consists of the particulate acidic refractory oxide and includes no further ingredients, such as a metal.

Murachi discloses a zeolite substrate, but the zeolite has metals attached, such as copper and iron. See col. 16, lines 50-56 of Murachi. It is noted that Murachi discloses alumina as a support, but the alumina further comprises precious metals, such as platinum or palladium, attached to the alumina. See col. 4, lines 50-56 and col. 5, lines 44-53 of Murachi. Therefore, Murachi fails to disclose or suggest a catalyst consisting of a particulate acidic refractory oxide selected from the group consisting of zeolites, tungsten-doped titania, silica-titania, zirconia-titania, gamma-alumina, amorphous silica-alumina and mixtures of any two or more thereof.

Subramanian fails to remedy the deficiencies of Murachi. Subramanian discloses a first stage catalyst comprising a transition metal-containing zeolite. The second stage catalyst has a high surface area alumina support, but it is impregnated with lanthana, palladium, and titania.

Col. 1, lines 46-58. Thus, a separate metal is always included with the support. Therefore, Subramanian also fails to disclose or suggest a catalyst consisting of a particulate acidic refractory oxide selected from the group consisting of zeolites, tungsten-doped titania, silica-titania, zirconia-titania, gamma-alumina, amorphous silica-alumina and mixtures of any two or more thereof.

Moreover, Murachi and Subramanian teach away from the claimed invention by requiring the use of a metal in the catalyst. All of the catalyst and absorbents of Murachi and Subramanian require some type of metal in the catalyst to function, i.e., oxidize, absorb, or reduce. In the claimed invention of claim 43, however, no metals need be present on the catalyst because the acidic particulate refractory oxide materials are especially active. See page 4, lines 9-11 of the original specification.

More particularly, Murachi teaches away from the claimed invention by using a basic metal in the NO_x absorbent. The NO_x absorbent in Murachi contains a precious metal and at least one substance selected from alkali metals (i.e., potassium, sodium, etc.) and alkaline-earth metals (i.e., barium, calcium, etc.). Alkali and alkaline-earth metals are well known to those of ordinary skill in the art as basic metals (i.e., pH > 7). Such basic metals are desirable in NO_x absorbents because NO₂ in the exhaust gas is generally acidic and is absorbed onto the basic metals. As described in the present application, however, it was found that acidic particulate refractory oxide materials are particularly active for decomposing NO₂ to NO. Pg. 4, lines 9-11 of the original specification. Thus, the NO_x absorbent requires a basic metal, whereas the claimed invention requires an acidic refractory oxide. Adding a basic metal to an acidic compound would be counter-intuitive and counter-productive. Accordingly, Murachi teaches away from the claimed invention.

Accordingly, as none of the references, alone or in any reasonable combination, teaches each of the claimed limitations and in fact teaches away from the claimed invention, a *prima facie* case of obviousness has not been established, and claim 43 should be in condition for allowance. Claims 44-55 depend, directly or indirectly, from claim 43 and should be deemed allowable as dependent thereon. As stated previously, Applicants request that claim 7 be considered along with claim 43.

Conclusion

For all of the foregoing reasons, Applicants respectfully request reconsideration and allowance of the claims. Applicants invite the examiner to contact their undersigned representative if it appears that this may expedite examination.

Respectfully submitted,



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